

CLAIMS

1. A wurtzite thin film containing crystals of a wurtzite structure compound, and

a polarizability X of crystal grains of the crystals being in a range of $51 \% \leq X \leq 100 \%$.

2. The wurtzite thin film as set forth in claim 1, wherein the crystals of the wurtzite structure compound orient with respect to a (0002) surface.

3. The wurtzite thin film as set forth in claim 1 or 2, being made of one compound selected from the group consisting of aluminum nitride, gallium nitride, indium nitride and zinc oxide, or being made of two compounds or more selected from the group consisting of aluminum nitride, gallium nitride, indium nitride and zinc oxide.

4. A method for manufacturing a wurtzite thin film containing crystals of a wurtzite structure compound,

the wurtzite thin film being formed by sputtering so that a polarizability X of crystal grains in the wurtzite thin film is in a range of $51 \% \leq X \leq 100 \%$.

5. The method as set forth in claim 4, wherein the wurtzite thin film is formed on a substrate having any one

of a monocrystalline structure, a polycrystal structure and an amorphous structure.

6. The method as set forth in claim 5, wherein a temperature of the substrate is in a range from a room temperature to 800 °C when forming the wurtzite thin film on the substrate.

7. The method as set forth in any one of claims 4 to 6, wherein a sputtering pressure is in a range from 0.05 Pa to 0.5 Pa when forming the wurtzite thin film by sputtering.

8. The method as set forth in any one of claims 4 to 7, wherein:

a sputtering gas used for sputtering includes at least argon and nitrogen; and

a nitrogen concentration in the sputtering gas is in a range from 5 % to 90 %.

9. The method as set forth in claim 8, wherein the sputtering gas contains 0.2 % to 10 % of oxygen.

10. The method as set forth in any one of claims 4 to 9, wherein a high-frequency power density used for

forming the wurtzite thin film by sputtering is in a range from 1 W/cm² to 12 W/cm².

11. The method as set forth in any one of claims 4 to 10, wherein the wurtzite thin film is formed so as to have a thickness of 25 nm or more.

12. The method as set forth in any one of claims 4 to 11, wherein the wurtzite thin film is made of one compound selected from the group consisting of aluminum nitride, gallium nitride, indium nitride and zinc oxide, or is made of two compounds or more selected from the group consisting of aluminum nitride, gallium nitride, indium nitride and zinc oxide.

13. A laminate comprising:

a substrate;

a first wurtzite crystalline layer made of a wurtzite crystalline structure compound;

a functional material layer which covers an entire region of the first wurtzite crystalline layer; and

a second wurtzite crystalline layer which covers the functional material layer and is made of the wurtzite crystalline structure compound, and

the first wurtzite crystalline layer, the functional

material layer and the second wurtzite crystalline layer being stacked on or above the substrate.

14. The laminate as set forth in claim 13, wherein the substrate is made of any one of a monocrystalline material, a polycrystal material and an amorphous material.

15. The laminate as set forth in claim 13 or 14, wherein a c axis perpendicular to a (0001) surface of the wurtzite crystalline structure compound constituting the first wurtzite crystalline layer and the second wurtzite crystalline layer orients substantially perpendicular to a surface of the substrate.

16. The laminate as set forth in any one of claims 13 to 15, wherein the first wurtzite crystalline layer and/or the second wurtzite crystalline layer contain as a main constituent one compound or more selected from the group consisting of aluminum nitride, gallium nitride, indium nitride and zinc oxide.

17. The laminate as set forth in any one of claims 13 to 16, wherein the first wurtzite crystalline layer and the second wurtzite crystalline layer contain aluminum

nitride as the main constituent.

18. The laminate as set forth in any one of claims 13 to 17, wherein the first wurtzite crystalline layer and the second wurtzite crystalline layer are made of a same constituent(s).

19. The laminate as set forth in any one of claims 13 to 18, wherein the functional material layer contains any one of a monocrystalline material, a polycrystalline material and an amorphous material.

20. The laminate as set forth in any one of claims 13 to 19, wherein the functional material layer contains a conductive material.

21. The laminate as set forth in any one of claims 13 to 20, wherein the functional material layer contains a metal.

22. The laminate as set forth in claim 21, wherein the functional material layer contains a metal having a body-centered cubic structure or a hexagonal close-packed lattice structure.

23. The laminate as set forth in any one of claims 13 to 22, wherein the functional material layer is made of an elementary substance of molybdenum or tungsten, or a compound containing at least one of molybdenum and tungsten.

24. The laminate as set forth in any one of claims 13 to 23, wherein the first wurtzite crystalline layer has a thickness of 5 nm or more.

25. The laminate as set forth in any one of claims 13 to 24, wherein the first wurtzite crystalline layer has a thickness of 50 nm to 200 nm.

26. A method for manufacturing a laminate, comprising the steps of:

forming on a substrate a first wurtzite crystalline layer made of a wurtzite crystalline structure compound;

forming a functional material layer so that the functional material layer covers the first wurtzite crystalline layer; and

forming on the functional material layer a second wurtzite crystalline layer made of the wurtzite crystalline structure compound,

at least one of the steps being carried out by a

vapor deposition.

27. The method as set forth in claim 26, wherein the vapor deposition is a physical vapor deposition and/or a chemical vapor deposition.

28. The method as set forth in claim 27, wherein the physical vapor deposition is a vacuum deposition, a molecular beam epitaxy, a laser ablation, a sputter deposition, an ion plating, an ion cluster beam deposition or an ion beam deposition.

29. The method as set forth in claim 27 or 28, wherein the chemical vapor deposition is a thermal CVD, a photochemical vapor deposition, a high-frequency plasma CVD, a micro wave plasma CVD, an ECR plasma CVD or a DC plasma CVD.